



City of North Las Vegas Building and Fire Safety Liquefied Carbon Dioxide Guidelines

Installation shall be in accordance with the 2018 International Fire Code (IFC) and 2016 NFPA 55 *Standard for the Storage, Use and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationery Containers Cylinder and Tanks*.

1. Construction and operational permits shall be obtained for liquefied carbon dioxide containers or systems where the system capacity exceeds 100 lbs as indicated in table 105.6.10 of the IFC.
2. All facilities utilizing a Co2 system(s) - an assembly of equipment consisting of a tank, container or containers, appurtenances, pumps, compressors and connecting piping - shall be provided with an approved hazardous level detection system **IFC 102.9**. Audible and visible notification shall be provided throughout the facility upon alarm. **IFC 908**. Co2 alarm system control panel shall be located outside the area subject to enrichment. The system may require supervision and monitoring **IFC 5004.9 and 5004.10**.
3. Equipment (meters or gauges or sensors) shall be provided to indicate Co2 levels in each grow cultivation area/room and interior Co2 storage locations.
 - (a) **Interior storage** room meters shall be calibrated and inter-connected to a gas supply valve (that positively closes) located at the storage container(s) to limit Co2 levels to a maximum of 5000 ppm. Co2 store rooms will require an amber strobe and audible horn inside and outside the room at each entrance which will alert building occupants when the sensor reaches 5,000 ppm in that room. The notification appliances shall be rated a minimum of 100cd for a visible effect and 75 dBA for an audible effect. A Co2 sensor with an integral audible visual will be allowed inside the storage room in lieu of a dedicated notification appliance. Signage will be required adjacent to these horn strobes. There must be signage within 4 inches beneath all amber strobes that states: (outside the room) “DO NOT ENTER WHEN LIGHT IS FLASHING - - CARBON DIOXIDE LEAK DETECTED” and (inside the room) “FLASHING LIGHT MEANS CARBON DIOXIDE LEAK DETECTED – EVACUATE ROOM.”
 - (b) **Grow cultivation area/room** meters shall be calibrated and inter-connected to a gas supply valve (that positively closes) located at the storage container(s) or a gas supply valve (that positively closes) for each grow area/room to limit Co2 levels to a maximum of 5,000 ppm. Each grow area/room will require an amber strobe and audible horn inside and outside the area/room which will alert building occupants when the sensor reaches 5,000 ppm in that area/room. The notification appliances shall be rated a minimum of 100cd for a visible effect and 75 dBA for an audible effect. A Co2 sensor with an integral audible visual will be allowed inside the grow area/room in lieu of a dedicated notification appliance. There must be signage within 4 inches beneath all amber strobes that states: (outside the room) “DO NOT ENTER WHEN LIGHT IS FLASHING - - CARBON DIOXIDE LEAK DETECTED” and (inside the room) “FLASHING LIGHT MEANS CARBON DIOXIDE LEAK DETECTED – EVACUATE ROOM.”
4. All systems must have valves that positively close in the event of a loss of electrical power to

the Co2 sensors. A minimum of one (1) portable Co2 meter shall be in use during business hours.

5. Signage shall be provided on the exterior door of each grow cultivation room/area utilizing Co2 and in each room storing Co2 stating: "DANGER! Potential Oxygen Deficient Atmosphere". NFPA 704 Simple Asphyxiant placards shall also be provided at the exterior main entrance and at rooms where Co2 is used or stored.
6. All sensors, alarms and storage containers must be inspected and tested annually or as prescribed by the manufacturer. A written record of all required inspection and testing shall be maintained on the premises for a period of three years.
7. Testing of emergency devices or systems required by the fire code official shall be conducted by persons trained and qualified in these systems.
8. All employees shall receive annual training in hazard identification, physical properties and emergency procedures. Training records shall be available to inspectors upon request.
9. All submittals shall be prepared by a licensed State of Nevada architect or design professional or other approved contractor(s) and shall be in compliance with City of North Las Vegas Standards. ***IFC 5503.1.1.1. At least two copies of the following data shall be submitted to the fire code official:***
 - (1) Type and use of container, equipment or device.
 - (2) Material to be stored, used or transported.
 - (3) Description showing dimensions and materials used in construction.
 - (4) Design pressure, maximum operating pressure and test pressure.
 - (5) Type, size and setting of pressure relief devices.
 - (6) Other data requested by the fire code official.
 - (a) Location of Co2 container including Co2 container size, weight, state of contents (liquid or gas) and quantity. Location of vaporizer if used.
 - (b) Symbol legend with equipment description (manufacture's name and model number) and mounting description (surface, semi flush, flush, and exterior).
 - (c) Site plan.
 - (d) Floor plan drawn to an indicated scale (1/8" minimum) on sheets of a uniform size showing:
 - (i) Point of compass (north arrow).
 - (ii) Walls, doors, windows, openings, stairs, elevators, passageways, high-piled storage racks, etc., as applicable to depict the facility.
 - (iii) Room use identification labels (i.e., kitchen, dining room, storage room, etc.)
 - (iv) Gas piping distribution systems, manifolds, sizes and material types and piping hangers and slopes.
 - (v) Valves and valve boxes, outlets, gages and other components.
 - (vi) Location (mounting height etc.) of Co2 sensors.
 - (vii) Electrical warning systems (local alarm audible/visual appliance), conductor/conduit routing and size, power panel and circuit connection.
 - (viii) Location of warning signs. Details for warning signs such as text, size, color and attachment method.
 - (ix) Product data submittal including a cover index sheet itemizing products used by make and model number and manufacturer data sheets (highlighted or marked) information for equipment, devices, and materials used.
 - (x) Design number and detail of penetration fire stop system when required.
 - (xi) Demonstration of compliance via notes, plans, and details with the applicable

items listed in this the Co2 guideline or Code sections.

10. **Sizing** - Pressure relief device vent piping shall have a cross-sectional area not less than that of the pressure relief device vent opening and shall be arranged so as not to restrict the flow of escaping gas *IFC 5503.3.1*.

Marking - Cryogenic containers and systems shall be marked in accordance with Sections 5503.4.1 through 5503.4.6 *IFC 5503.4*.

Identification signs - Visible hazard identification signs in accordance with NFPA 704 shall be provided at entrances to buildings or areas, in which cryogenic fluids are stored, handled or used *IFC 5503.4.1*.

Identification of contents - Stationary and portable containers shall be marked with the name of the gas contained. Stationary aboveground containers shall be placarded in accordance with Sections 5003.5 and 5003.6. Portable containers shall be identified in accordance with CGA C7 *IFC 5503.4.2*.

Identification of containers - Stationary containers shall be identified with the manufacturing specification and maximum allowable working pressure with a permanent nameplate. The nameplate shall be installed on the container in an accessible location. The nameplate shall be marked in accordance with the ASME Boiler and Pressure Vessel Code or DOTn 49 CFR Parts 100185 *IFC 5503.4.3*.

Identification of container connections - Container inlet and outlet connections, liquid level limit controls, valves and pressure gauges shall be identified in accordance with one of the following: marked with a permanent tag or label identifying their function, or identified by a schematic drawing which portrays their function and designates whether they are connected to the vapor or liquid space of the container. Where a schematic drawing is provided, it shall be attached to the container and maintained in a legible condition *IFC 5503.4.4*.

Identification of piping systems - Piping systems shall be identified in accordance with ASME A13.1 *IFC 5503.4.5*.

Identification of emergency shutoff valves - Emergency shutoff valves shall be identified and the location shall be clearly visible and indicated by means of a sign *IFC 5503.4.6*.

Securing of containers - Stationary containers shall be secured to foundations in accordance with the International Building Code. Portable containers subject to shifting or upset shall be secured. Nesting shall be an acceptable means of securing containers *IFC 5503.5.2*.

Securing of vaporizers - Vaporizers, heat exchangers and similar equipment shall be anchored to a suitable foundation and its connecting piping shall be sufficiently flexible to provide for the effects of expansion and contraction due to temperature changes *IFC 5503.5.3*.

Physical protection- Containers, piping, valves, pressure relief devices, regulating equipment and other appurtenances shall be protected against physical damage and tampering *IFC 5503.5.4.*

Lighting - When required, lighting, including emergency lighting, shall be provided for fire appliances and operating facilities such as walkways, control valves and gates ancillary to stationary containers *IFC 5503.10.*

Stationary containers - Stationary containers shall be installed in accordance with the provisions applicable to the type of fluid stored and this section *IFC 5504.2.1.*

Containers - Stationary containers shall comply with Section 5503.1 *IFC 5504.2.1.1.*

Construction of indoor areas - Cryogenic fluids in stationary containers stored indoors shall be located in buildings, rooms or areas constructed in accordance with the International Building Code *IFC 5504.2.1.2.*

Ventilation - Storage areas for stationary containers shall be ventilated in accordance with the Uniform Mechanical Code *IFC 5504.2.1.3.*

Portable containers - Indoor storage of portable containers shall comply with the provisions applicable to the type of fluid stored and Sections 5504.2.2.1 through 5504.2.2.3 *IFC 5504.2.2.*

Containers - Portable containers shall comply with Section 5503.1 *IFC 5504.2.2.1.*

Construction of indoor areas - Cryogenic fluids in portable containers stored indoors shall be stored in buildings, rooms or areas constructed in accordance with the International Building Code *IFC 5504.2.2.2.*

Ventilation - Storage areas shall be ventilated in accordance with the Uniform Mechanical Code *IFC 5504.2.2.3.*

Valves and accessory equipment - Valves and accessory equipment shall be suitable for the intended use at the temperatures of the application and shall be designed and constructed to withstand the maximum pressure at the minimum temperature to which they will be subjected *IFC 5505.1.2.3.*

Shutoff valves on containers - Shutoff valves shall be provided on all container connections except for pressure relief devices. Shutoff valves shall be provided with access thereto and located as close as practical to the container *IFC 5505.1.2.3.1.*

Physical protection and support - Piping systems shall be supported and protected from physical damage. Piping passing through walls shall be protected from mechanical damage *IFC 5505.1.2.4.*

11. **Pressure Relief Devices** - Containers used for liquid carbon dioxide shall be equipped with pressure relief devices piped from the uppermost part of the containers and communicating with the vapor space *NFPA 55 13.1.1.*

Vent piping systems serving pressure relief devices shall be protected from water intrusion to prevent moisture or solid carbon dioxide from collecting and freezing and interfering with the operation of the pressure relief device ***NFPA 55 13.1.1.2.2.***

Containers, cylinders, and tanks shall be provided with a pressure gauge and level gauge or device for indicating the quantity of liquid carbon dioxide ***NFPA 55 13.1.2.1.***

Where containers, cylinders, and tanks are in locations remote from the filling connection, a means to determine when the containers have been filled to their design capacity shall be provided and shall be verifiable from the filling connection ***NFPA 55 13.1.2.3.***

Carbon dioxide piping shall be located and supported to protect against damage from strain on piping and fittings; the effects of expansion, contraction, and vibration; mechanical damage; and heat sources ***NFPA 55 13.1.3.1.***

Piping, tubing, and hoses and fittings shall be designed to a bursting pressure of at least four times the system design pressure ***NFPA 55 13.1.3.2.***

Materials of construction shall be employed for potential exposure to a temperature of -109.3 ***NFPA 55 13.1.4***